INTERNATIONAL TECHNOLOGY CORPORATION

Project No. 301159
June 1988

Analytical Work Plan for Ground Water

Phase I Site Investigation and Analysis
Basin F Ground Water Treatment
Interim Response Action
Contract No. DACW45-88-D-0008

Rocky Mountain Arsenal
Commerce City, Colorado

Prepared for:

Department of the Army
Corps of Engineers, Omaha District
Omaha, Nebraska

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THIS SAMPLING AND ANALYSIS PLAN IS FOR THE GROUND WATER SAMPLES TO BE COLLECTED FROM THE SIX MONITORING WELLS LOCATED NORTH OF BASIN F. THE PLAN CONTAINS INFORMATION ON THE FOLLOWING:

1. PURGING OF THE WELLS
2. MEASUREMENT OF FIELD PARAMETERS
3. SAMPLE COLLECTION
4. SAMPLE PRESERVATION AND HANDLING
5. CHAIN-OF-CUSTODY CONTROL
6. ANALYTICAL PROCEDURES
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ANALYTICAL WORK PLAN FOR GROUND WATER
PHASE I SITE INVESTIGATION AND ANALYSIS
BASIN F GROUND WATER TREATMENT INTERIM RESPONSE ACTION
ROCKY MOUNTAIN ARSENAL, COLORADO

Prepared for:

Department of the Army
Corps of Engineers, Omaha District
Contract Number DACW45-88-D-008

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1.0 INTRODUCTION

This sampling and analyses plan is for the ground water samples to be collected from the six monitoring wells located north of Basin F at the Rocky Mountain Arsenal. This plan contains information regarding the following:

- Purging of the well
- Measurement of field parameters
- Sample collection
- Sample preservation and handling
- Chain of custody control
- Analytical procedures
- Field and laboratory quality assurance/quality control

2.0 GROUND WATER SAMPLING

Ground water from the six wells will be collected by the Program Manager--Rocky Mountain Arsenal, Technical Operations Division (PM-RMA, TOD) representatives for analyses of the parameters listed on Table 1. Table 1 parameters will be analyzed by the A-E contract laboratory, IT Analytical Services, Export, PA, while Table 2 parameters will be analyzed by the government laboratory. Details of sampling and analytical parameters for the government analyzed samples are addressed in the Rocky Mountain Arsenal, Comprehensive Monitoring Program, Ground Water Monitoring Technical Plan.

2.1 MEASUREMENT OF ORGANIC VAPORS AT THE BREATHING ZONE

The air in the well head as well as in the breathing zone will be measured immediately after the unlocking of the well for organic vapors using a organic vapor analyzer such as an HNu, photo-ionization detector. This information will be useful for Health and Safety protection requirements as well as an indicator of the possible presence of light phase immiscible layers floating in the well. The Safety, Health and Emergency Response Plan (SHERP) details the level-of-protection requirements for the concentration of organic vapors that may be encountered during the sampling process.

2.2 MEASUREMENT OF STATIC WATER LEVELS

Water level measurements will be taken before the purging of the well using a water level tape or electrical well sounder. The depth to standing water as well as the total depth of the well will be determined. This information is

required to calculate the volume of water in the well casing and provides a check on the integrity of the well (i.e., identifies any silting problems). These measurements will be determined to the nearest 0.01 foot. Each well will have a permanent, easily identifiable reference point from which water level and depth of well measurements can be obtained. The well identifier will also be indelibly marked on the well for identification.

2.3 DETECTION OF IMMISCIBLE LAYERS

A clear bailer will be used to determine the presence of any "sinkers" or "floaters" in the stagnant well water. "Sinkers" are those relatively insoluble organic liquids which are more dense than water and tend to migrate toward the bottom of the well bore. "Floaters" are those relatively insoluble organic liquids that are less dense than water and that tend to occur at the water table. IT will provide a clear bailer to the PM-RMA, TOD for their use in the detection of these layers. The bailer will be first lowered slightly below the stagnant water layer and gently removed from the well and examined for an immiscible phase. The process will be repeated for the detection of potential sinking phases by carefully lowering the bailer to the bottom of the well screen and removing it to examine it for an immiscible phase. The sampling team shall make note of the approximate thickness of each layer if they are present.

2.4 WELL EVACUATION

The water standing in a well prior to sampling may not be representative of the in situ ground water quality. Therefore the sampling team must remove the standing water in the well and filter pack so that formation water can replace the stagnant water. Each well will be purged using a bailer, bladder pump or air-driven piston pump for a minimum of three well casing volumes; purging is then continued until the field parameters have stabilized to within 10 percent of the previous values. Field parameters will be measured a minimum of three times, i.e., after each well bore volume. If the field parameters have stabilized after the purging of three well casings, sampling may begin. The field parameters to be measured are temperature, pH, and specific conductance. The pH and specific conductance instruments will be standardized at least daily. Field parameters will be measured after the samples for laboratory analyses have been collected to ensure that the ground water parameters have remained

stable during sample collection. In cases where the well recovers slowly such that three well bore volumes cannot be removed before the well is evacuated to dryness, the sampling team will purge to dryness. Once the well has recovered sufficiently to allow collection of all the samples necessary for laboratory analyses, the sampling process will begin. Measures shall be taken to prevent surface soils from coming in contact with the purging equipment and lines, which in turn could introduce contaminants to the well. Purged water should be collected and drummed for proper disposal.

2.5 SAMPLE COLLECTION

The technique used to withdraw a ground water sample from a well is based on the considerations of the parameters to be analyzed in the sample. To improve the degree to which the ground water sample is representative of the formation, it is important to minimize physically altering or chemically contaminating the sample during the sampling process.

Samples for laboratory chemical analyses will be collected in the order of decreasing volatile sensitivity of the parameters as follows:

Volatile Organic Compounds (VOA)
Extractable Organics (BNAs, Pesticides)
Total Metals
Dissolved Metals
Sulfate and Chloride
Turbidity
Nitrate and Ammonia

Temperature, pH, and specific conductivity measurements shall be made in the field during the purging activity, and before and after the ground water samples are collected. At the conclusion of sampling each well, the sampling device shall be decontaminated. At no time will a sampling device that has not been decontaminated be introduced into the well. Section 2.5.2 discusses the decontamination procedures in detail.

If pumping is used to collect the sample for volatile organic compounds the pumping rate should not exceed 100 milliliters per minute. Higher pumping rates can increase the loss of volatile constituents and can cause fluctuations in the pH value and pH sensitive analytes. When the volatile samples have been collected the pumping rate may be increased but at no time should it exceed the pumping rate used during the purging process.

2.5.1 Sample Preservation and Handling

Many of the chemical constituents and physicochemical parameters that are to be analyzed or evaluated are not chemically stable, therefore sample preservation is required. Table 1 lists the preservatives and containers to be utilized for the parameters to be analyzed by IT-Export. IT will provide containers and labels for Table 1 samples. As indicated in Table 2, the containers and preservatives for the government-operated laboratory samples will be in accordance with the Rocky Mountain Arsenal Comprehensive Monitoring Program, Ground Water Monitoring Technical Plan. Samples collected for volatile organic analyses will be collected in 40-ml amber glass vials using teflon-septum lined caps. Samples for volatiles should be transferred from the sampling device taking care to minimize volatilization. Sample containers will be sealed with no headspace present. Total organic carbon samples should be handled and analyzed as materials containing volatile organics. No headspace should exist in the sample containers at the time of receipt by the laboratory, as well as at the time the sample was collected. Ground water samples for metal analyses will be field filtered through a 0.45 micron membrane filter and transferred to a bottle containing the nitric acid for preserving the sample. Particles must be filtered out since they may absorb or adsorb various ionic species and effectively lower the dissolved metal content in the well water.

2.5.2 Decontamination Procedures for Non-Dedicated Equipment

All non-dedicated sampling and measuring equipment shall be decontaminated before introduction into a well. Decontamination will consist of a deionized water rinse followed by washing with a non phosphate detergent and a second rinse with deionized water. Following this washing a methanol rinse followed by another deionized rinse shall be performed. This procedure applies to all sampling equipment as well as water level/well sounding equipment and field measuring devices.

2.6 CHAIN-OF-CUSTODY

An adequate chain-of-custody shall allow for the tracing of possession and handling of the individual samples from the time of sample collection through laboratory analyses. A chain-of-custody and water sample collection infor-

mation shall be recorded completely and transferred to IT Corporation personnel with the samples to be shipped to the IT Laboratory. Copies of all paperwork regarding the samples shipped to the government laboratory will be transferred to IT Corporation personnel at this time. Key elements of the chain-of-custody procedure include:

- sample labels--prevents misidentification of samples (Figure 1)
- sample seals (custody tape)--provides evidence that the sample has been unopened until time of laboratory analyses
- water sample collection log--provides information on the collection of the sample and its physicochemical condition upon collection (Figure 2)

  chain-of-custody record--establishes the documentation necessary to trace sample possession from the time of collection to analyses (Figure 3)
- request-for-analysis--serves as the official "work order" explaining the analytical program to the laboratory, for each sample (Figure 4).

2.7 FORM COMPLETION AND RECORDS MAINTENANCE

All forms shall be completed, addressing each item on the form. If a particular item is not applicable to the work performed, a line or N/A will be used to indicate this. All records will be filed at the IT-Englewood office in accordance with the standard IT filing system as described in the IT QA Manual.

3.0 ANALYTICAL PROCEDURES/PROTOCOLS

Table 3 outlines the analytical procedures for the analyses of samples to be analyzed by IT-Export. The procedures are EPA-approved methods and are suitable analytical methods for the samples collected. Table 3 also provides expected precision and accuracy values for the methods presuming that the collected water does not have matrix interference problems. It should be noted that these procedures do not necessarily apply to the government laboratory analytical protocol since the government laboratory procedures are governed by USATHAMA QA/QC procedures.

3.1 FIELD AND LABORATORY QUALITY ASSURANCE/QUALITY CONTROL

The establishment of a sound quality assurance/quality control (QA/QC) program is of utmost importance to ensure the reliability and validity of the field and analytical laboratory data gathered as part of the overall ground water monitoring program.

3.1.1 Field QA/QC Program

Two types of field QA/QC samples will be collected as part of the ground water sampling program: field equipment rinsate blanks and field duplicates. These samples will be collected by the PM, RMA TOD. IT will supply containers and labels for the QA/QC samples which relate to the samples to be analyzed by IT. The equipment rinsate blank will only be collected for the metals analyses. A field duplicate will be collected for all the parameters to be analyzed. The equipment rinsate blank is collected to document the cleanliness of the non-dedicated sampling device. This sample is collected from the final rinsate after deconning the sample collection device. If this analysis shows contamination, the results of this analysis will not be used to correct the ground water data (i.e., subtracted from any positive results). The source of the contamination would be identified and corrective action, including possible resampling as an option, can be initiated. The field duplicate shall be analyzed for all the same parameters as its common sample. A fictitious sample designation is assigned to the duplicate to provide a "blind" sample to the laboratory. This provides a check on the laboratory precision as well as a check of the field collection reproducibility. The error associated with either field or laboratory reproducibility cannot be distinguished if this samples identity is disguised. It should be emphasized that data from QC samples should be used as a measure of performance or as an indicator of potential sources of cross-contamination, but should not be used to alter or correct analytical data.

3.1.2 Laboratory QA/QC Program

The laboratory QA/QC program is detailed in two documents. IT Analytical Services Quality Assurance Manual and the supplemental Laboratory Specific Attachment for the IT-Export laboratory. The laboratory-specific attachment defines more clearly specific details discussed in the corporate IT QA Manual such as calibration practices and reporting procedures. It is recognized that

some quality assurance practices vary in each of the IT laboratories, therefore, the lab-specific attachment is used as a supplement to the corporate ITAS Quality Assurance Manual. Appendix A is a reproduction of the Table of Contents from the IT-Export laboratory specific attachment to the IT Corporate QA manual. QA/QC requirements for the PM, RMA TOD laboratory analyses are presented in the Rocky Mountain Arsenal Comprehensive Monitoring Program, Ground Water Monitoring Technical Plan.

4.0 REQUIRED PLANS AND REPORTS

These are required plans and reports for this phase of work that adequately document quality aspects of the work.

4.1 A-E QUALITY CONTROL PLAN (A-E QCP)

The A-E QCP is a working document that outlines the respective COE and A-E quality control related responsibilities for this project. This Analytical Plan for water serves that purpose.

4.2 A-E QUALITY MANAGEMENT PLAN (A-E Lab QMP)

The A-E Lab QMP is an "off-the-shelf" brochure which describes the laboratories personnel qualifications, equipment, analytical capabilities, quality control program, and other related topics specific to the functioning of the laboratory. Two documents function as the IT-Export QMP. These documents are the ITAS Corporate Quality Assurance Manual and the laboratory-specific attachment for the IT-Export laboratory. A copy of the outline of the laboratory specific attachment is provided in Appendix A.

4.3 A-E DAILY QUALITY CONTROL REPORT (A-E DQCR)

The A-E DQCR is a report documenting daily project activities submitted to the PM-COE at regular intervals. The A-E DQCR will be completed throughout the duration of the on-site sample collection and/or field analysis period. An example of the form to be utilized for the DQCR is provided as Figure 5 in this plan.

4.4 A-E QUALITY CONTROL SUMMARY REPORT (A-E QCSR)

The A-E QCSR is a report that will be submitted at the conclusion of the sampling and analyses period that summarizes the results of the Daily Quality Control Reports, A-E laboratory analyses and associated quality control samples. Information presented will be a tabular summary of the data, raw data and any observations made relating to the obtained data.

5.0 EVALUATION OF THE QUALITY OF GROUND WATER CHEMICAL DATA

The ground water sampling and analyses program produces a variety of ground water chemical constituent data. The chemical data may be presented in a data summary package in tabular and graphical forms. Tabular formats may be as simple as presenting the data as it is received from the analyzing laboratory. Summaries of the laboratory data may aid in its interpretation. Graphical presentations of data can aid in the interpretive process and may also be used. All tabulations of data must be accompanied by an explanation assessing its validity, completeness, representativeness and accuracy. Any data gaps, QC problems or deviations in detection limit and precision should be addressed in the data summary package.

TABLE 1

GROUND WATER SAMPLING SPECIFICATIONS FOR BASIN F
(IT-EXPORT SAMPLES)

PARAMETER	CONTAINER	SAMPLE PRESERVATION	HOLDING TIME
Dissolved Solids (Total)	1-liter glass bottle filtered on site	Ice to 4°C	Analyze in 7 days
Organic Carbon (Total)	1-liter glass bottle	Acidify to ph < 2 (HCl) Ice to 4°C	Analyze in 28 days
Total Metals	1-liter high density polyethylene bottle	Acidify to pH < 2 (1:1 HNO_3)	6 months
Ammonium	1-liter glass bottle	H_2SO_4 to ph < 2 Ice to 4°C	Analyze in 28 days
Silica, Dissolved	200 ml. high density polyethylene bottle	Ice to 4°C	Analyze in 28 days
Bicarbonate	200 ml. glass bottle	Ice to 4°C	Analyze in 14 days

TABLE 2

ANALYTICAL PARAMETERS/COMPOUNDS FOR BASIN F GROUND WATER MONITORING PROGRAM TO BE ANALYZED BY GOVERNMENT LABORATORY

METALS/ICP/AA

Arsenic
Cadmium
Calcium
Chromium
Copper
Lead
Magnesium
Mercury
Potassium
Sodium
Zinc

ANIONS/GENERAL CHEMISTRY

Alkalinity
Chloride
Conductivity
Fluoride
Nitrate
Nitrite
Sulfate
pH

ORGANOCHLORINE PESTICIDES (GCECD)

Aldrin
Dieldrin
Endrin
Hexachlorocyclopentadiene (HCCP)
Isodrin
2,2-bis(para-chlorophenyl)-1,1-Dichloroethane (P,P'-DDE)

SEMIVOLATILE ORGANIC COMPOUNDS (GCMS)

Dibromochloropropane (DBCP)
Dicyclopentadiene (DCPD)
Diisopropylmethylphosphate (DIMP)
Dimethylmethylphosphonate (DMMP)

ORGANOSULFUR COMPOUNDS (GCFPD)

Chlorophenylmethylsulfide (PCPMS)
Chlorophenylmethylsulfone (PCPMSO)
Chlorophenylmethylsulfoxide (PCPMSO2)
Dithiane
1,4-Oxathiane

TABLE 2
(Continued)

VOLATILE ORGANIC COMPOUNDS (GCPID)

Benzene
Ethylbenzene
M-xylene
O- and P-xylene
Toluene

VOLATILE HALOGENATED ORGANIC COMPOUNDS (GCCON/GCHALL)

1,1-Dichloroethane
1,1-Dichloroethene
1,2-Dichloroethane
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethene
Tetrachloroethene
Carbon Tetrachloride
Chlorobenzene
Chloroform
Methylene chloride

SAMPLING AND PRESERVATION REQUIREMENTS

(Refer to the Rocky Mountain Arsenal
Comprehensive Monitoring Program,
Ground Water Monitoring Technical Plan.)

TABLE 3

GROUND WATER ANALYTICAL SPECIFICATIONS (IT EXPORT)
FOR BASIN F GROUND WATER SAMPLES

PARAMETER	METHOD NUMBER	EXPECTED DETECTION LIMIT	EXPECTED PRECISION
Dissolved Solids	160.1	10 mg/l	±20%
Organic Carbon	415.1	1 mg/l	±20%
Total Metals	200.7	Iron 0.025 mg/l	±20%
		Manganese 0.015 mg/l	±20%
		Nickel 0.040 mg/l	±20%
Ammonium	350.2	0.05 mg/l	±20%
Silica	Lachat Method No. 10-114-27-1-A	0.01 mg/l	±20%
Bicarbonate	310.1	1 mg/l	±20%

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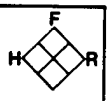
SOIL SAMPLE



Project Name _____

Project No. _____

Sample No. _____

Collection Date/Time _____

Collector's Name _____

Sample Location _____ Boring No. _____

Depth Sampled _____

Sample Type ☐ Disturbed ☐ Undisturbed ☐ Other _____

Blow Count _____ Recovery _____

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FIGURE 1

INTERNATIONAL TECHNOLOGY CORPORATION

GROUND WATER SAMPLE COLLECTION LOG

Project Name: _____
Project No.: _____
Request-for-Analysis Control No.: _____
Chain-of-Custody Control No.: _____

Sample No.: _____
Sample Location or Well I.D. (attach map if necessary): _____
Date and Time Collected: _____
Sample Collected By: _____

EQUIPMENT

Purging Method/Equipment: _____

Sampling Equipment: _____

Filtering Equipment: _____

Equipment Calibration

EQUIPMENT MODEL	SERIAL NO.	DATE CALIBRATED

pH		
STANDARD TEMP	STANDARD READING	STANDARD READING

CONDUCTIVITY	
TEMP	STANDARD READING

Other Calibration (e.g. D.O., eH):

Equipment Decontamination:

FIELD PARAMETERS

Water Sample Temperature ( ): _____ Sampling Depth ( ): _____

Air Temperature ( ): _____ Initial Depth to Water ( ): _____

pH: _____ Reference Point: _____

Conductance (μmhos/cm): _____ (Corrected to 25°C (Y/N) _____)

Floating Phase (Y/N) ___ Thickness: _____ ( ) Sinking Phase (Y/N) ___ Thickness _____ ( )

SAMPLE PACKAGING

Chemical Group	VOC Including Diethylether & Tetrahyrofuran	General * Chemical Parameters	BNA	Pest & PCBs	Dissolved Metals (Filtered)	Total Metals (Not Filtered)	Others			
Preservative	4°c	4°c	4°c	4°c	HNO_3; 4°c	4°c				
Container Type & Volume	Glass 2x40ml	Plastic 1 Liter	Glass 1 Gal.	Glass 1 Gal.	500ml. Wide Mouth Poly-ethylene	Polyethylene 1 Liter				
Sampled (Y/N)										

* Ammonia and Sulfite are not included.

FIGURE 2

INTERNATIONAL TECHNOLOGY CORPORATION

CHAIN-OF-CUSTODY RECORD

R/A Control No. _____

C/C Control No 015207

PROJECT NAME/NUMBER _____ LAB DESTINATION _____

SAMPLE TEAM MEMBERS _____ CARRIER/WAYBILL NO. _____

Sample Number	Sample Location and Description	Date and Time Collected	Sample Type	Container Type	Condition on Receipt (Name and Date)	Disposal Record No.

Special Instructions: _____

Possible Sample Hazards: _____

SIGNATURES: (Name, Company, Date and Time)

1. Relinquished By: _____

   Received By: _____

2. Relinquished By: _____

   Received By: _____

3. Relinquished By: _____

   Received by: _____

4. Relinquished By: _____

   Received By: _____

WHITE - To accompany samples
YELLOW - Field copy

FIGURE 3

INTERNATIONAL TECHNOLOGY CORPORATION

REQUEST FOR ANALYSIS

R/A Control No. 01[illegible]94

C/C Control No. _____

PROJECT NAME _____

PROJECT NUMBER _____

PROJECT MANAGER _____

BILL TO _____

_____

_____

PURCHASE ORDER NO. _____

DATE SAMPLES SHIPPED _____

LAB DESTINATION _____

LABORATORY CONTACT _____

SEND LAB REPORT TO _____

_____

_____

DATE REPORT REQUIRED _____

PROJECT CONTACT _____

PROJECT CONTACT PHONE NO. _____

Sample No.	Sample Type	Sample Volume	Preservative	Requested Testing Program	Special Instructions

TURNAROUND TIME REQUIRED: (Rush must be approved by the Project Manager.)

Normal _____ **Rush** _____ (Subject to rush surcharge)

POSSIBLE HAZARD IDENTIFICATION: (Please indicate if sample(s) are hazardous materials and/or suspected to contain high levels of hazardous substances)

Nonhazard _____ **Flammable** _____ **Skin Irritant** _____ **Highly Toxic** _____ **Other** _____ **(Please Specify)**

SAMPLE DISPOSAL: (Please indicate disposition of sample following analysis. Lab will charge for packing, shipping, and disposal.)

Return to Client _____ **Disposal by Lab** _____

FOR LAB USE ONLY

Received By _____ **Date/Time** _____

WHITE - Original, to accompany samples
YELLOW - Field copy

FIGURE 4

INTERNATIONAL TECHNOLOGY CORPORATION

DAILY QUALITY CONTROL REPORT

DATE: _____

PROJECT NAME: _____
PROJECT NUMBER: _____
SHEET _____ OF _____

WEATHER

Temp _____
Wind Velocity/Direction _____

Precipitation _____
Other _____

WORK PERFORMED: _____

SAMPLING PERFORMED: (Type, location, etc.) _____

SAMPLES COLLECTED: (Numbers, analysis, etc.) _____

FIELD ANALYSIS PERFORMED: (Type, etc.) _____

PROBLEMS ENCOUNTERED/CORRECTIVE ACTIONS: _____

QUALITY CONTROL ACTIVITIES INITIATED: (e.g., Blanks, duplicates, calibration, etc.) _____

Personnel On-site _____	Important Telephone Calls _____
Visitors _____	

Field Engineer _____ (Print) Signature _____

FIGURE 5

APPENDIX A

TABLE OF CONTENTS FROM LABORATORY SPECIFIC ATTACHMENT (IT-EXPORT)

PITTSBURGH LAB-SPECIFIC QA MANUAL

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